Center Innovation Fund: KSC CIF

Novel Materials for Biofilm Inhibition

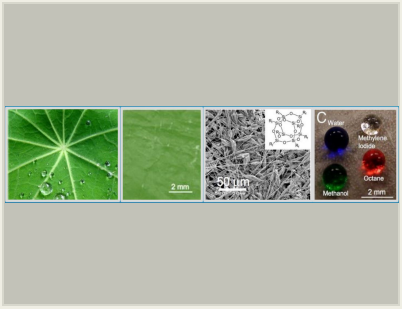
Completed Technology Project (2016 - 2017)

Project Introduction

Determine to what extent the physical properties of the omniphobic and PC coatings will increase resistance to microbial attachment and subsequent biofilm formation. Long-term control of microbial contamination and biofilm development in systems, particularly in the water storage/distribution systems and in food production/storage materials. Initial testing on coupons (both metal and polymer-based) with multiple omniphobic and PC coatings will be completed to optimize and down-select top-performing treatments for biofilm resistance. Partners at the University of Michigan will fabricate and provide different omniphobic surfaces possessing hierarchical texture on various polymer and metal coupons. Similarly, the PVA Tepla America team will treat the various materials with various PC-based compounds. Physical characterization using X-ray Photon Spectroscopy (XPS), Scanning Electron Microscopy (SEM), as well as surface roughness and contact angle/surface free energy analysis will be completed, and, if possible, treatments will be down-selected for microbial testing. A NASA Research Announcement has been submitted which would provide additional funding to evolve the project for an International Space Station (ISS) flight demonstration of the technology.

Anticipated Benefits

Inhibit biofilm formation in any water system through the use of novel omniphobic and phosphorylcholine (PC) coatings. Microbial contamination onboard the International Space Station (ISS) continues to pose significant mission risks, both in terms of crew health and functionality of mechanical systems. The presence of opportunistic pathogens in potable water systems, in food production systems, and on surfaces within the crew cabin, combined with lowered immune system function in crewmembers, presents the possibility for serious illness. Similar contamination issues could be seen in future flight and surface systems.



Omniphobic coatings. Lotus leaves repel water, but not octane. Surface becomes omniphobic after being covered with electrospun fibers (beads-on-strings morphology) of PMMA + 44 wt% fluorodecyl POSS.

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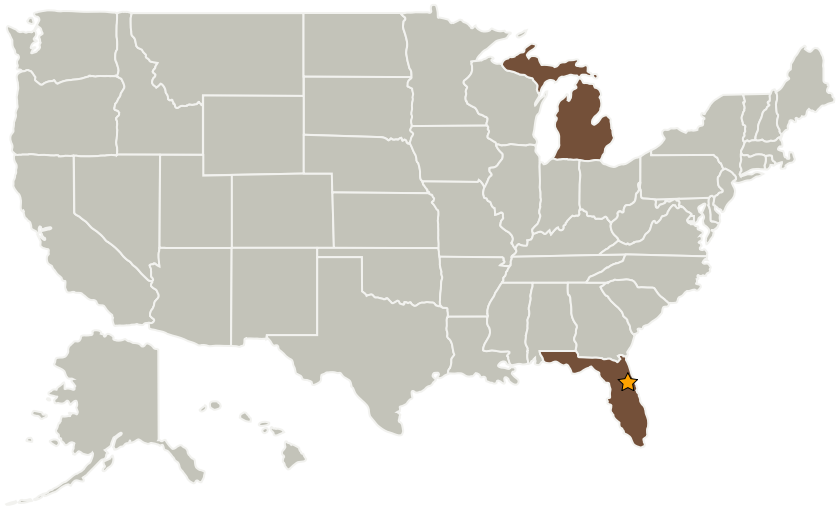
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Kennedy Space Center(KSC)	Lead Organization	NASA Center	Kennedy Space Center, Florida
University of Michigan-Ann Arbor	Supporting Organization	Academia	Ann Arbor, Michigan

Primary U.S. Work Locations	
Florida	Michigan

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Kennedy Space Center (KSC)

Responsible Program:

Center Innovation Fund: KSC CIF

Project Management

Program Director:

Michael R Lapointe

Program Manager:

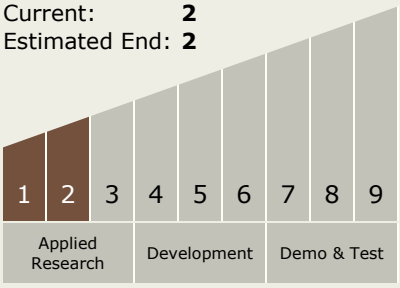
Barbara L Brown

Principal Investigator:

Luke B Roberson

Technology Maturity (TRL)

Start: **1**
Current: **2**
Estimated End: **2**



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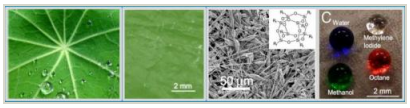
Images



Project Image
Omniphobic coatings. Lotus leaves repel water, but not octane. Surface becomes omniphobic after being covered with electrospun fibers (beads-on-strings morphology) of PMMA + 44 wt% fluorodecyl POSS.
(https://techport.nasa.gov/image/35769)

Technology Areas

Primary:

- TX06 Human Health, Life Support, and Habitation Systems
  - TX06.1 Environmental Control & Life Support Systems (ECLSS) and Habitation Systems
    - TX06.1.2 Water Recovery and Management

Target Destinations

Mars, Outside the Solar System, Earth